MICROSCOPE DRAPE LENS PROTECTIVE COVER ASSEMBLY

This invention relates to a surgical microscope lens protective cover assembly of the kind used in conjunction with sterile drapes which maintain a sterile field above a patient during the performance of an invasive surgical procedure.

BACKGROUND OF THE INVENTION

The use of a surgical microscope by a surgeon during an invasive surgical procedure is common. The surgical microscope conventionally includes an objective lens housing or barrel typically enclosed within a sterile drape constituted by a thin, plastic film. The drape conventionally has an opening therein through which the objective lens housing of the microscope projects so that the drape film does not interfere with the ability of the surgeon to maintain clear visibility of the surgical site. The opening through which the objective lens housing extends conventionally is provided with a seal so as to avoid the provision of a path adjacent the opening through which contamination may pass. Some of the known constructions have elastic fittings which grip the objective lens housing and support transparent window-like panes through which light may pass from the microscope to illuminate the surgical field.

The use of conventional microscope lens protective cover assemblies has presented two distinct

problems: first, the transparent window-like pane may become contaminated by spurting biological fluids. Cleaning or replacement of the pane is both difficult and time consuming, particularly when the cleaning or replacement must be accomplished by gloved-hand personnel.

The second difficulty attributable to surgical microscope lens cover assemblies is the presence of undesirable transient light or glare caused by reflection or refraction of light in such manner as to interfere with the surgeon's view of the surgical site.

A principal object of the invention is to overcome the difficulties noted above with respect to heretofore available protective lens cover assemblies.

SUMMARY OF THE INVENTION

Apparatus constructed in accordance with the invention is adapted for use in conjunction with a surgical microscope of the kind having eyepieces through which one or more persons, such as a surgeon and assistants, may view a surgical site. A typical surgical microscope is mounted on a support which enables the microscope to be positioned at a level above or to one side of a patient, the microscope having an objective lens assembly mounted within a housing or barrel which may be positioned a selected distance from the site. Conventionally, the microscope

includes a source of light which passes through the objective lens housing for illuminating the surgical site. Since the microscope quite often is positioned very close to the surgical site it is not uncommon for surgical procedures to cause body fluids to traverse the distance between the patient and the objective lens and contaminate and/or smear the latter. Contamination of the lens interferes with the surgeon's view of the surgical site.

Because of the proximity of the microscope to the surgical site on some occasions it is customary to enclose the microscope within a sterile drape. It also is conventional to provide a protective cover or shield for the outermost objective lens of the microscope, the shield being removable for replacement in the event it becomes contaminated or smeared by contact with body fluids. The cleaning or replacement of a contaminated lens shield or cover frequently is hampered by the necessity of the person charged with cleaning or replacement to be gloved.

Another frequently encountered problem when using surgical microscopes is that the optical path from the surgical site to the eyepieces may be distorted, obscured, or blurred by the reflection or refraction of light either from the illuminating source or from other lighting in the area where the surgery is being conducted. Sometimes the lens cover or shield

when in its best position for optical acuity is subjected to glare which cannot be removed if the lens is to remain in its optimum position. Apparatus constructed in accordance with the invention provides an additional or secondary holder for a shield or cover which can be applied to the objective lens barrel in such manner as to enable the shield to be both rocked and rotated to any selected one of a number of adjusted positions in which the visual acuity is optimum. The construction of the apparatus according to the invention is such as to facilitate not only the attachment of the additional shield holder to the lens barrel but also enable extremely rapid and facile adjustment of the holder and the shield carried thereby, while ensuring snug retention of the holder in its selected position of adjustment.

THE DRAWINGS

The foregoing characteristics of the invention are disclosed in the following description and illustrated in the accompanying drawings wherein:

Figure 1 is a fragmentary, isometric view illustrating the lower end of a surgical microscope's objective lens barrel, a portion of a sterile drape, and a two-part, separable assembly for the removable support of a protective shield;

Figure 2 is an enlarged, transverse sectional view of a portion of the apparatus shown in Figure 1;

Figure 3 is a fragmentary, greatly enlarged view of a portion of the apparatus shown in Figure 2;

Figure 4 is an exploded, isometric view of the components of the apparatus;

Figure 5 is an isometric view, on an enlarged scale, of a shield forming part of the apparatus; and

Figure 6 is a bottom plan view of the assembled apparatus shown in Figure 4.

THE PREFERRED EMBODIMENT

Apparatus constructed in accordance with the preferred embodiment of the invention is especially adapted for use with a surgical microscope of known construction having an objective lens housing or barrel 1 which extends beyond the microscope housing and contains objective lenses (not shown) through which light may pass from a source (not shown) of illumination through the housing to the surgical site, and thence, to the eyepiece or eyepieces (not shown) through which a surgeon and/or assistants may view the site. The housing 1 typically has a cylindrical wall 2 having a free end 3 encircled by circumferentially spaced, longitudinally extending ribs 4 which project radially outwardly. The apparatus described thus far is conventional and forms no part of the invention except for the manner in which it cooperates with apparatus yet to be described.

The preferred embodiment of the invention comprises a first annular retainer 5 and a second annular retainer 6. The first retainer may be used independently of the second retainer 6 or in conjunction with the latter as will be explained hereinafter.

The first retainer 5 has a annular wall 7 terminating at one end in a radially directed flange 8 having a smooth, flat or planar surface 9. The opposite end of the wall 7 terminates in a flat or planar surface 10. The external surface 11 of the wall 7 is frusto-spherical for a purpose subsequently to be explained.

The inner surface of the wall 7 forms a cylindrical bore 12 joined at its upper end to a radially inwardly extending projection 13 terminating at its upper end in a tapered mouth 14. Adjacent its lower end the surface of the bore 12 is joined to an inwardly projecting, continuous, annular, upper rib 15 which is axially spaced from a second or lower inwardly projecting rib 16. The ribs 15 and 16 are axially spaced apart so as to form between them a continuous groove 17.

The wall 7 is provided with a notch 18 at a selected zone and such slot also extends through the corresponding zone of the lowermost rib 16. However, the upper rib 15 is continuous.

Adapted for removable accommodation in the annular groove 17 formed by the ribs 15 and 16 is a transparent cover or shield 19 formed of glass or suitable plastic material, as is conventional. The shield 19 is cylindrical except for a tab 20 which extends radially and is provided with a reinforcement 21 which is adhesively or otherwise suitably secured to the tab 20. The tab and reinforcement extend through the notch 18 when the shield 19 is accommodated in the annular groove 17.

The apparatus thus far described is adapted to be used in conjunction with a sterile drape D comprising a sheet of thin, pliable, transparent material, such as a copolymer capable of being heat sealed to the surface of the flange 8 at the upper end of the first retainer 5. The drape is provided with an opening O for the accommodation of the lower portion of the objective lens barrel 1 of the surgical microscope.

When the drape D is secured to the flange 8 the drape and the first retainer 5 form an integral, unitary construction which may be assembled with the surgical microscope. To perform the assembly the drape D is so oriented to the barrel 1 that the mouth 14 of the retainer 5 underlies the free end of the objective barrel 1 so that the retainer 5 may be applied in encircling relation to the lower end of the barrel. Assembly is facilitated by the tapered mouth of the

retainer. The material from which the retainer 5 is made preferably is elastomeric and has sufficient elasticity to enable it to grip the projections 4 and snugly, but removably, maintain the retainer on the barrel. A suitable material is that manufactured and sold by Shell Oil Company under the trademark KRATON.

The transparent shield 19 may be fitted into the annular groove 17 of the retainer 5 either before or after the latter is fitted to the lower edge of the barrel 1. It will be understood that the drape D is of such size as to envelope a surgical microscope and maintain a sterile environment above the surgical site.

Following assembly of the retainer and shield 19 with the lens barrel 1, the shield provides a protective cover for the lenses in the barrel so as to shield them from contamination by body fluids or other sources during the performance of the surgical procedure. Should one shield 19 be subjected to smearing from an attendant's gloved hand or some other source, such shield may be removed from the retainer and replaced by another. The tab 20 and the notch 18 facilitate the removal and replacement of shields.

Although the lower rib 16 which assists in forming the annular groove 17 is discontinuous at the zone of the notch 18, the upper rib 15 is continuous, thereby ensuring an effective contamination barrier at the juncture of the retainer 5 and the lens barrel 1.

There are instances when circumstances are such that the view through the microscope of the surgical site is somewhat impaired by glare produced by reflection or refraction of the site-illuminating light generated by the microscope or by the reflection or refraction of ambient light from other sources. In these instances the glare can be eliminated or greatly minimized by the use of the second retainer 6.

The retainer 6 comprises a frusto-conical wall 22 having an outer surface 23 and a smooth inner surface 24 forming a tapered bore. The diameter of the bore at its upper, smaller diameter end is slightly less than that of the outer surface 11 of the wall 7 at its maximum diameter, whereas the diameter of the larger end of the bore 24 is greater than that of the outer surface 11 of the wall 7 at its maximum diameter. The material from which the retainer 6 is made may be the elastic polymer, KRATON, thereby enabling the smaller diameter end of the wall 22 to be flexed outwardly a distance sufficient to permit the retainer 6 to be mounted on and supported by the retainer 5.

Adjacent the larger diameter end of the wall 22 is an endless groove 25 having a continuous upper edge 26 and a tapered lower edge 27 formed by a lip 28. Both the wall 22 and the lip 28 are discontinuous at corresponding zones to provide a notch 29.

A transparent shield or cover 30 like the shield 19 has a laterally projecting tab 31 provided with a reinforcement 32 so as to facilitate movement of the shield 30 into and out of the groove 25.

When use of the second retainer 6 is deemed desirable it may be fitted onto the retainer 5 simply by placing its smaller diameter and in register with the retainer 5 and moving it axially upwardly to the position in which the smaller diameter end of the bore 24 has passed the maximum diameter of the surface 11 of the wall 7. See Figures 2 and 3. The inner surface of the bore of the retainer wall 6 then will engage the wall 7 and the retainer 6 will be suspended from the retainer 5.

Although the shield 19 may remain in assembled relation with the retainer 5, it is contemplated that, when the retainer 6 and its associated shield 30 are used, the shield 19 will be removed from the retainer 5.

Once the retainer 6 is assembled on the retainer 5, the retainer 6 may be rocked about an arc having a radius corresponding to that of the arcuate surface 11 of the wall 7, as is indicated by the double arrow 33 in Figure 2. The retainer 6 also may be rotated relative to the retainer 5. To facilitate such rocking and rotation, the retainer 6 may be adjusted axially, as indicated by the double arrow 34 in Figure

2, so as to disengage the surfaces 7 and 24, thereby minimizing or eliminating the frictional force between the retainers 5 and 6. Once the retainer 6 has been rotated or rocked to the desired position, it may be moved downwardly so as once again to effect snug engagement between the engaged walls of the retainers and maintain the retainer 6 in any selected one of a number of adjusted positions relative to the retainer 5. The engagement between the confronting walls of the retainers 5 and 6 will ensure contact therebetween sufficient to block the passage of contaminants.

If the shield 19 is maintained within the retainer 5 when the retainer 6 is mounted on the retainer 5, the shield 19 cannot be removed from the retainer 5 without first removing the retainer 6. However, in this circumstance the shield 19 will be protected by the shield 30. The shield 30, of course, can be removed from the retainer 6 any time and replaced by another.

The disclosed embodiment is representative of a presently preferred form of the invention, but is intended to be illustrative rather than definitive thereof. The invention is defined in the claims.